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# Assessing Social Networks in Patients with Schizophrenia: A Systematic Review of Instruments

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## **Abstract**

**Background.** Evidence suggests that social networks of patients with schizophrenia influence symptoms, quality of life and treatment outcomes. It is therefore important to assess social networks for which appropriate and preferably established instruments should be used.

**Aims.** To identify instruments assessing social networks in studies of patients with schizophrenia and explore their properties.

**Method.** A systematic search of electronic databases was conducted to identify studies that used a measure of social networks in patients with schizophrenia.

**Results.** Eight instruments were identified, which had been used in 65 studies (total N of patients = 8,522), and were all published before 1991. They assess one or more aspects of social networks such as their size, structure, dimensionality and quality. Most instruments had various shortcomings, including questionable inter-rater and test-retest reliability.

**Conclusions.** The assessment of social networks in patients with schizophrenia is characterized by a variety of approaches which may reflect the complexity of the construct. Further research on social networks in patients with schizophrenia would benefit from advanced and more precise instruments using comparable definitions of and timescales for social networks across studies.

**Declaration of interest:** none declared.

## **Introduction**

Social network is a term used to describe the social ties linking individuals to other individuals through communication (Cohen and Sokolovsky, 1979). It is a social structure comprised of sets of interactions and defined by relationships between individuals.

Evidence suggests that social networks are linked to the onset of schizophrenia and treatment outcomes of patients. Social networks were found to deteriorate prior to contact with services as a consequence of periods of untreated psychosis (Thorup et al., 2006; Jeppesen et al., 2008). In the examination of precursors to onset and recovery for mental illness, low levels of social support and poor social networks were suggested to increase the probability of onset of illness and decrease the probability of recovery. Moreover, better social networks have been associated with more favourable quality of life and fewer hospitalisations (Albert et al., 1998, Becker et al., 1998b, Bankole et al., 2006, Eklund and Hansson 2007). An accurate assessment of social networks in patients with schizophrenia is therefore important.

For assessing social networks, a technique called social network analysis was originally developed by anthropologists in order to provide qualitative descriptions of living systems in complex societies (Epstein, 1961; Mitchel, 1969, Boissevain, 1978). This technique was later applied to the problem of discovering and assessing the social support available to individuals in stressful situations, including but not limited to individuals with schizophrenia. Later on, empirical studies and theoretical work concerning social networks and schizophrenia became predominantly focused on qualitative aspects (Randolph, 1998).

An assessment of social networks in patients with schizophrenia may have to consider that social networks in these patients can be different from social networks in the general population. Their social networks are substantially smaller than those of people without mental illness. In most studies, social network is reported to consist of less than 10 members (Bengtsson-tops, 2001; Cohen and Sokolovsky, 1978, Meeks & Murrel, 1994; Macdonald et al., 2000), and patients report having fewer people to turn into a crisis and fewer friends (Macdonald et al. 2000). Social networks of patients with schizophrenia also tend to be less stable, and – over time – can become even more restricted and less capable of providing the degree and type of support required for community integration (Becker et al. 1998, Bengtsson-Tops, 2004).

In an early review, Jackson and Edwards (1992) identified eight instruments measuring social networks and social support in schizophrenia in thirteen studies, out of which only four measured social networks specifically. The authors criticised a poor reliability and validity of existing instruments.

The review of Jackson and Edwards (1992) did not use a systematic search method, did not include any literature published after 1989, and did not focus in their identification of instruments with schizophrenia or severe mental illness. We therefore aimed to conduct a new review addressing the above shortcomings, i.e. using a systematic method of searching studies and collecting the relevant information, including papers published since 1989, and focusing on standardised assessment instruments for patients with schizophrenia.

## **Methods**

We conducted a systematic review of studies assessing social networks in patients with schizophrenia and identified the standardised instruments that were used to assess specifically social networks in these studies.

### Search Strategy

A protocol was developed using the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA; Moher et al., 2009) statement. The electronic databases Medline, Embase, PsychInfo, Web of Knowledge, British Nursing Index (BNI) and Cumulated Index to Nursing and Allied Health Literature (CINAHL) were searched. Search terms were a combination of social contact assessment descriptors and schizophrenia patient descriptors (*social contact* OR *social assessment* OR *social network*) AND (*psychosis* OR *schiz\** OR "*psychotic disorder*"). Grey literature databases were searched using the above search terms and thus papers were identified searching their title abstract and full text with the aforementioned search terms.

Studies were also identified through citations from relevant literature reviews looking at social networks in people with mental illness and a key journal hand-search of articles related to social networks was conducted with the reference lists of relevant articles. In order to make sure that all relevant papers were retrieved, a citation tracking element was used as part of the search strategy: citations of relevant papers (those describing instruments that have been included in the review) were searched using the Web of Science data base ([www.webofknowledge.com](http://www.webofknowledge.com)).

### Eligibility Criteria

We included studies that used measures aiming to assess social networks of people with a diagnosis of schizophrenia. Studies that used alternative diagnostic classifications or self-report diagnoses were translated into the appropriate International Classification of Diseases (10<sup>th</sup> version) code (F20-F29) (World Health Organisation, 1977; 1992). We included studies that had more than 50% of the sample population diagnosed with schizophrenia or related mental health disorders, and used any type of standardised social networks measurement, with the exception of studies assessing exclusively interactions between the patient and family members. We included studies of all designs, of any publication year, and with samples of all ages, genders, and nationalities.

In case of doubts on the inclusion of papers the first authors of these publications were contacted.

### Study selection, data extraction and analysis

All potential studies were exported into a reference citation manager and duplications removed. The primary author (JS) removed duplications and conducted the initial screening of titles and abstracts for inclusion. A random selection of 25% of the abstracts was then screened by the second author (CG). If there was any ambiguity on the eligibility of the study, the full paper article was obtained and reviewed between the two authors (JS and CG). Inter-reviewer agreement was 90%, with disagreement on the inclusion of only one paper, which was brought to the third author (SP). Selected full-text articles were then obtained for the final screening. Final study selection was

completed by two independent authors (JS and CG) with a third author (SP) helping to resolve disagreements. The details of the selection procedure are displayed in the PRISMA diagram (Figure 1).

Data extraction was completed by two reviewers (JS) and (CG) with a third reviewer adjudicating in the event of disagreement (SP). The data extraction tool was piloted to ensure proper documentation of the qualitative and quantitative components of the included studies.

Once finalized, data were extracted on study design, patient characteristics, assessment method, study findings, as well as extracting data specific for assessment (e.g. structure, time period, items, rater, results and emphasis). Main themes emerging from the papers and instruments were identified independently by JS and CG. When we could not obtain the original instruments, we attempted to assess the description of them in the included papers to reproduce the required information.

There was little inter-reviewer disagreement and any differences that were identified were resolved through discussion of the paper and the third reviewer (SP). JS and CG were in 100% agreement for all papers and instruments extracted and was not required to consult a third party (SP). For assessment instruments that could not be found, (CG) made direct contact requesting the necessary information to complete the synthesis. If the authors or relevant authority could not be contacted or did not respond, their papers and instruments were not included in this review (as a result, only one instrument– the Personal Network Interview (as referenced in Stein et al. 1995) could not be included as the author for this instrument is unknown).

The papers were analysed descriptively.

## **Results**

### **Selection of studies**

The selection of papers is shown in Figure 1.

Insert Figure 1 about here

A total of 509 records were retrieved. After the removal of duplicates and the application of inclusion and exclusion criteria on abstracts, 152 full-text papers were examined. After closer examination and conducting a final screen, as well as a citation tracking of relevant papers, 65 studies using standardised social networks instruments in schizophrenia were included in the review. Eight papers used data from one dataset, three papers included data from one dataset and another three included data from the same data set.

Eight standardised social networks assessment tools were identified from these papers. The two most widely applied measures were the Interview Schedule for Social Interaction (ISSI; Henderson et

al., 1980), used in 23 identified studies, and the Social Network Schedule (SNS; Dunn et al., 1990), applied in 21 studies.

### General characteristics of tools

The characteristics of the eight social networks instruments are summarised in Table 1. For four instruments we could not obtain the original schedules (ISSI, SNI, SSSNI, PPKI), however we judged that the description from included papers provided the required information.

Insert table 1 about here

The included assessments were published between 1972 and 1990. The total number of patients with schizophrenia assessed using these tools was 8,522. The majority of instruments assess what the link is between the patient and their contacts across a certain time period. The most common type of assessment is a semi structured interview although structured interviews and questionnaires were also used.

All assessment instruments are rated by an independent observer (with the exception of SRS and ASSIS that contain self-rated scales). The time taken to rate a patient's social networks ranges from ten minutes (e.g., SNS) to two and a half hours (e.g., NAP). The number of questions devoted to social contacts ranges from six (e.g. SRS) to 17 (NAP), with a total number of items ranging from eight to 50 items.

Most scales (seven out of eight) provide a quantifiable view of the network offering results in the form of either a score or percentage attributed to all social networks members (eg: how much of the network is made of family, friends, others) or a percentage of time spent socializing (the SNS). In terms of measuring satisfaction with different aspects of the network, only two scales incorporated this aspect. The SRS and ASSIS require respondents to indicate appraisal of each relationship using a Likert rating scale.

Instruments vary in the time period covered (i.e., from the past month to the past year), and contacts can be difficult to recall for lengthier time periods. Some measures require participants to name only those persons they had contact with during a specified time frame (the SNS, NAP, ASSIS and SNI specify the previous month), others do not provide a time frame (ISSI) whilst the SSSNI is unclear.

### Instruments

The most commonly used measures, the ISSI and the SNS, share a key conceptualisation of social networks as measuring both network structure and network quality variables.

The SNS has a strong focus on quantitative methodology which includes measures on different contact modalities (e.g., face to face, telephone) as well as the frequency of communication and the relationship to that contact allowing for measuring total size of network as well as individual means for each component – size of network made of relatives/friends/confidants and so on).

A time budget, which provides a structure and helps patients recall their interactions is usually completed beforehand to elicit names of social contacts in the past month and six questions are asked for each of them (e.g., “how often do you see X” and “would you miss X if you never saw him/her again?”). The SNS was designed for inpatient populations and acknowledges the importance of transactions within wards (e.g. of lending and borrowing cigarettes) by differentiating between types of social interactions into conversational, non-verbal and salutatory. Reciprocity is thus assessed by acknowledging the behavioural significance assigned to each contact. Data gathered with this instrument can also be analysed as a sociogram. Also, the SNS takes considerably less time to administer than the ISSI (15-20 minutes compared to 45 minutes) which may be an important factor when interviewing patients with schizophrenia in lengthy research interviews.

The ISSI is split into four main scores: the availability of attachment (AVAT), the availability of social integration (AVSI), the perceived adequacy of attachment (ADAT), and the adequacy of social integration (ADSI). The first two categories (i.e. AVAT and AVSI) examine the quantitative aspects of social networks whereas the last two sub instruments tap into the qualitative aspects and examine more closely the satisfaction with relationships, by asking participants whether the amount of each relationship available to them is appropriate or if they would like more or less of it. Whilst mean scores can be obtained for individual subsections, a total ISSI score can also be calculated and ranges from 0 to 30.

The Network Analysis Profile (NAP; Sokolovsky and Cohen, 1981) or modified versions, has been used in 15 studies. It is a semi-structured interview that examines several aspects of social interaction including linkages between kin members, non-kin members, and formal members (e.g., agency). A modified version (Cohen and Kockanowicz, 1989) further included structural dimensions (e.g., size, density, degree, clusters), interactional dimension (e.g., exchange, sustenance, directionality) and affective dimensions (e.g., positives including importance, friend, intimacy, reliability, satisfaction and negatives including critique, bossy, and intrusive) and the results can be interpreted either as a score or a pictogram. This instrument was particularly used in studies of older adults with schizophrenia.

The other five instruments have been found to be used in only one to three studies.

The Social Relationship Scale (SRS, McFarlane et al., 1981) provides a measure of patients’ appraisal of social support and the effectiveness of the support they receive on top of availability of support. The Adolescent Social Relationship Scale (ASRS, Macdonald et al., 1996) was adapted from McFarlane et al.’s (1981) Social Relationship Scale to measure the social networks of young people with and without psychosis and was used in only one study.

The Arizona Social Support Schedule (ASSIS; Barrera, 1981) assesses social network size, adequacy, and satisfaction alongside six social support functions (i.e, material aid, intimate interaction, feedback, guidance, physical assistance and social participation).

The Pattison Psychosocial Kinship Inventory (PPKI, Pattison and Pattison 1981) was one of the earliest instruments developed to identify the number of people, relationships, and interactions in

social networks. Patients are asked to list those who were important to them at the time of interview.

The Social Support and Social Network Interview (SSSNI, Lovell et al., 1984) is based on four probe questions in order to identify the respondent's network members (e.g.: "Who do you hang out for fun/relaxation, "Who would you go to for advice?") followed by their functions as well as relationship with the member.

The Social Network Interview (SNI) is a semi-structured interview covering information about interactions and starts off with questions about who they live with, contacts in their extended and nuclear family network, followed by specific questions to those who they feel close to.

### Reliability and Validity

Table 1 provides the available information about the psychometric properties of the instruments. Reliability and validity measures were not available for a number of instruments. Some were tested for stability (test-retest reliability, ISSI, ASSIS, PPKI, SRS; inter-rater reliability, SNS, NAP, SNI) and internal consistency (ISSI, PPKI, SRS), and some instruments were tested for construct and discriminant validity (SNS, ISSI). A few instruments were tested for both reliability and validity, using another measure of social contacts for validation purposes (SNS, ISSI).

## Discussion

### Main findings

We identified eight instruments that have been developed and used to assess social networks in patients with schizophrenia. They were used in 65 studies comprising a total of more than 8,500 patients. Yet, they vary in the assessed variables, in their definitions of social networks and in the time frames they refer to when asking patients about their contacts. All of the instruments were published before 1992, and they commonly have some methodological shortcomings.

### Strengths and limitations

This review used a systematic method to search the literature for relevant studies and collate the findings. We found a substantial number of studies with data from over 8,500 patients, from different countries and from different types of studies. In order to minimise the possibility of missing relevant data, different researchers independently reviewed the data. It is the first review of instruments assessing social networks in patients with schizophrenia since 1992, and – to our knowledge – the first one at all using these systematic methods.

However, the review also has at least three limitations. Firstly, we excluded one assessment tool for which the full text could not be found. Secondly, we included diagnostically mixed samples as long as



at least 50% of patients were diagnosed with schizophrenia or related disorders. And finally, we included only instruments that were explicitly specified to assess social networks. Thus, instruments that might assess relevant aspects of social networks, but use labels and terms other than social network were not considered.

### Comparison with the literature

More than 20 years after the review of Jackson and Edwards (1992), we still found that the concept of social networks remains heterogeneous throughout the literature and that subsequently the definition of social networks varies across instruments.

In the review of Jackson and Edward, four of the eight assessment instruments included in this review had not been considered (SNS, NAP, SNI and SSSNI), although only one of them has been published after 1989 (SNS), which is the final year considered in the review of Jackson and Edward. Of the 65 studies identified in this review however only six had been published before 1989. At the same time, Jackson and Edward had included instruments that we did not consider because of the narrower sole focus on social network assessments in this review.

Unlike Jackson and Edwards, we found that most scales incorporate both qualitative and quantitative social networks descriptors but because network quality is more methodologically problematic to assess, this infers a trade off in measurement accuracy. Due to differences between the quantitative versus qualitative components of social network assessed by the instruments, there is a high degree of variation of instruments included in this review and this makes comparison across studies difficult. Again, this reflects the lack of a unifying model of social networks in schizophrenia.

### Choosing an instrument

The review did not identify a gold standard in the assessment of social networks in schizophrenia. For selecting an instrument to assess social networks in patients with schizophrenia in research and routine service evaluation a number of aspects may need to be considered. Like in most selections of assessment instruments, there are general aspects. They include the purpose of the study, the role of the social network assessment in the study, the availability of data for relevant comparisons, the familiarity of the researchers with different instruments, practical issues such as the available time and training of the researchers, and characteristics of the setting and the patient sample.

In case all these general aspects do not determine the choice, the ISSI and SNS as particularly useful instruments. They have been used in more studies than other instruments and therefore have more options for the direct comparison of data. They also have relatively well-established properties. Similar advantages may apply to the NAP which however takes considerably longer to administer. An interview of about two hours just for assessing one concept, i.e. social networks, may be seen as too long for most studies or routine evaluations. assessments. Yet, the ISSI and the SNS may be more appropriate for different types of studies.

In studies investigating interventions that focus on existing relationships and on strengthening interactions with core members of a social network, the ISSI may be preferred as it provides measures of the availability and perceived adequacy of social contacts.

For evaluating interventions that aim to increase the size and strength of social networks, the SNS may be more suitable as a measure of social network size and the presence of confidants and supportive relationships. Another advantage of the SNS is the name generator approach used at the beginning of the interview. This enables an alternative analysis of the data through a sociogram of the network. Such a visual representation allows to evaluate the centrality of the network and to tap into specific functional supportive roles of different contacts.

### Implications for future research

The current state of the art in assessing social networks of patients with schizophrenia is limited due to the variety of understandings of the concepts and the absence of a consensus of the exact characteristics of a social network. This is reflected in the heterogeneity of existing instruments and the differences of approaches they use. Even when they refer to similar types of social contacts, they vary in the definition of contacts, the wording of questions, and the time frame to which the questions refer.

Some instruments use a patient's subjective appraisal of the "importance" or "closeness" of a relationship as the sole criterion for including the given contact in their social network. However, such appraisal may be biased by memory effects and emotional emphases (e.g., Pattison, 1981). Additionally, this approach (i.e., patient's appraisal of importance) may not correspond to the behavioural importance of that particular person as measured by exchanges of key goods, services or communication (e.g., "who did you see yesterday", "what did you do together").

The different and sometimes non-specified periods of time that the questions refer to are linked with problems of recall. Usually the questions refer to at least one month. Recalling all contacts during the last month or more can be difficult. Much shorter time frames such as the last one or two days would facilitate more precise recall, but may provide less meaningful and representative data. Also, the different time frames hinder direct comparisons. For comparisons across studies, consistent time frames would be needed.

Further research aiming to improve the existing instruments or develop new ones may consider a few core requirements:

- a) the difficulties of defining social contacts and networks cannot be avoided and clarity is required even if the definitions are not perfect;
- b) there should be a clear distinction between objective behavioural measures (e.g. actual meetings) and subjective appraisals of a relationship (e.g. trust and closeness);
- c) the timeframes to which the questions relate should be specified; shorter time frames of a few days may be less representative for the life of the patients but provide information that is less influenced by memory bias; and
- d) future assessments will have to include interactions in social media and through the internet, which existing instruments (developed before 1992) do not consider at all.

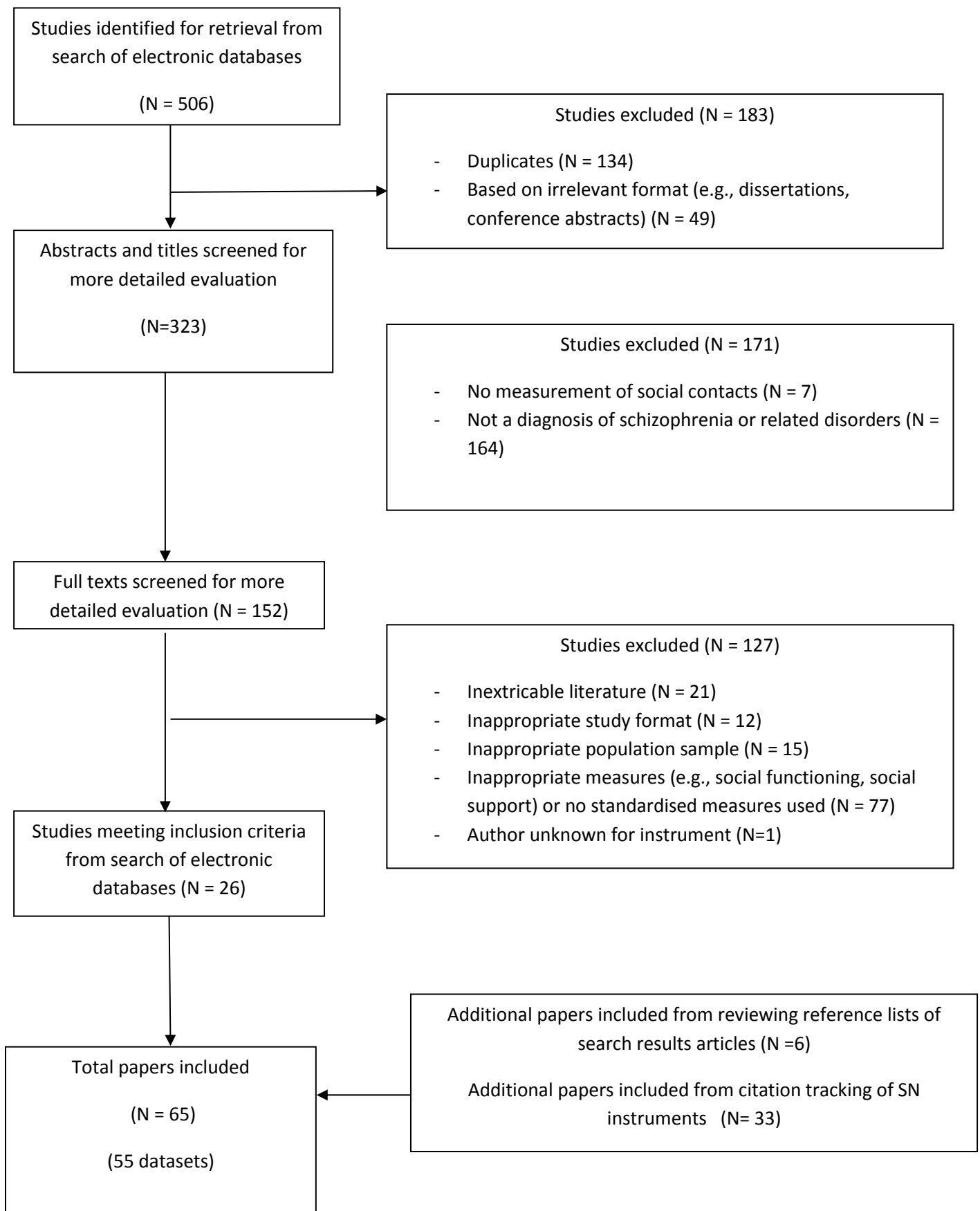
### Conclusions

The number of included studies suggest an interest and a need to assess social networks of patients with schizophrenia. Instruments for this purpose exist and have been used. Although the studies

using them provide some valuable findings, the state of the art in assessing social networks in patients with schizophrenia has not moved on since 1991, and further research is required to improve the feasibility and precision of instruments. Such research will have to accept the heterogeneity of the concepts of social networks and consider the specifics of social networks in patients with schizophrenia. A consensus about core aspects such as wording and time frames would help to make findings comparable across studies, but will be difficult to achieve.

There may also be a need to have specified instruments for different purposes. Such purposes include assessing social networks in large scale epidemiological studies; as moderators, mediators or outcomes in clinical trials (Bengtsson-Tops and Hansson, 2001); or as criterion for planning and evaluating services in routine care. For any of these purposes, better instruments would be helpful and likely to stimulate wider assessments of social networks.

Figure 1. PRISMA diagram



## Measures of social networks in schizophrenia

Measure	Author	Country	What is measured?			Time period covered	Items	Result	Rater	Rating form*	Time to rate (min)	Studies	Properties	Emphasis
			Quantitative	Qualitative	Network members									
Arizona Social Support Schedule (ASSIS)	Barrera, 1981	USA	Available network size; utilised network size; network density, material aid, social participation, negative interactions	Support satisfaction, support need, advice, positive feedback,	Friends, family, others arising from intimate interaction, , physical assistance,	Previous month	24	Score	Researcher	Q	15-20	1	High test re-test reliability for both perceived and actual network size in general <sup>1</sup> and depressed sample <sup>2</sup>	Structure of network and satisfaction of support
Interview Schedule for Social Interaction (ISSI)	Henderson et al., 1980	Australia	Availability of attachment and social integration	Perceived adequacy of attachment and social integration	Friends, family, others	At present ×	50	Score	Trained Interviewer	Q, I	45	23	Adequate reliability and validity in a schizophrenia sample <sup>3</sup>	Availability of social relationships
Network Analysis Profile (NAP)	Sokolovsky and Cohen, 1981	USA	Size, density, degree, total network configurations  (a modified version includes sustenance, reciprocity	Directionality, interactional content, intimacy	Family, friends, acquaintances, other	Previous month to hospitalisation	17 (modified version)	Score, mapping of network	Researcher	SSI	120	14	High inter-rater reliability in schizophrenia sample <sup>5</sup>	Structure of network
Pattison Psychosocial Kinship Inventory (PPKI)	Pattison, 1981	USA	Size, multiplexity, ireciprocity **	Frequency of contacts,	Family, relatives, friends, neighbours, co-workers, mental health professionals, acquaintance	At present ×	Not specified	Pictogram	Researcher	SSI	Not specified	2	Stability over 1 year and construct validity in a general population sample <sup>6</sup>	Structural, interactional and affective aspects of the social network.
Social Networks	Hammer 1981,	USA	Size, percent kin, density, degree of	-	Family, friends, neighbours,	Previous month to		Network size,	Trained	SSI	90	1	None detailed	Structure of

Interview (SNI)	Randolph 1982		linkages, reciprocity		colleagues, others	hospitalisation		reciprocity rating, proportion and average number of linkages	interviewer					network
Social Network Schedule (SNS)	Dunn et al., 1990	UK	Size, frequency of communication (seen, telephone), percentage time spent socializing	Quality of relationship, intimacy, content of relationship, intensity of interaction	Relative, acquaintance, professional, neighbour, others	Previous month to hospitalisation		Score or sociogram *	Researcher	SSI	15-20	19	High test re-test reliability at 10 days in a SMI sample <sup>11</sup>	Network support
Social Relationship Scale (SRS) <sup>1</sup>	McFarlane et al., 1981	Canada	Size, structure, reciprocity	Quality of network, , content of relationship	Spouse, siblings, parents, other relatives, friends, physicians, colleagues, neighbours, others	Previous 12 months to hospitalisation	6	Score	Researcher	RS	90	3	Reliable over time, inadequate content validity, reasonable degree of criterion validity in a general population sample <sup>12</sup>	Structure and quality of network
Social Support and Social Network Interview (SSSNI)	Lovell, Barrow and Hammer, 1984	USA	Size, density, frequency, degree, multiplexity	Quality of relationship, social support	People that provide support or service (relative, friends, acquaintances, professionals, other patients)	At present ×	6	Composition: percentage s density – ratio of linkages, multiplexity – average number of functions	Researcher	I	Not specified	2	Moderate test re-test reliability in a dual-diagnosis sample <sup>14</sup>	Social contact and support

\* Rating form consists of interviews (I), semi-structured interview (SSI), structured interview (SI), questionnaire (Q), and rating (RS).

\*\* Multiplexity refers to the number of different things done with a network member an instrumentality refers to how often each member provided emotional or practical support.

\*A pictorial method of mapping the personal links between individuals (Hammer, 1981)

× It is suggested by the authors that “Time Period Covered” refers to the moment the measure was used, as not enough information was provided either in the description of the instrument, nor in any of the studies using it as to the exact timeline measured

<sup>1</sup> Barrera et al., 1980; <sup>2</sup> Barrera and Garrison-Jones, 1992; <sup>3</sup> Bengtsson-tops, 2004; <sup>4</sup> Stevens, 1972; <sup>5</sup> Sokolovsky &Cohen, 1981; <sup>6</sup> Jennings et al., 1988; <sup>7</sup> Stein et al., 1995; <sup>8</sup> Power et al., 1988; <sup>9</sup> Mezey et al. 2012; <sup>10</sup> Magliano et al., 1998; <sup>11</sup> Dunn et al. 10990; <sup>12</sup> Trumbetta et al. 1998; <sup>13</sup> McFarlane et al., 1981; <sup>14</sup> Wilcox, 1981; <sup>15</sup> O’Connor and Brown, 1984.

Study	Country	Measure	Intervention	Primary Group	Group Size	Comparison Group	Group Size	Outcome
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**Supplementary Table 1. Measures of social networks in schizophrenia and their findings**

Measure	Findings
Arizona Social Support Schedule (ASSIS)	Social networks may predict mental health service utilisation.
Interview Schedule for Social Interaction (ISSI)	Poorer network in access, size, support unless living independently. Better social networks results in earlier discharge, faster recovery and fewer reported symptoms.
Network Analysis Profile (NAP)	Patients’ parents have larger Social networks compared to patients; patients’ Social networks stable across 15 months. Patients have small networks and this is similar cross-culturally. Past premorbid social adjustment does not affect network development.
Pattison Psychosocial Kinship Inventory (PPKI)	Patients with more negative symptoms have smaller social networks.
Social Networks Interview (SNI)	Patients’ parents have larger social networks compared to patients; patients’ social networks stable across 15 months.
Social Network Schedule (SNS)	Smaller social networks in intensive services; social contact correlates to quality of life; increased social networks decreases hospitalization; longer duration of service contact associated with larger network; network not associated with therapeutic relationship; smaller homes have more social cohesiveness; social networks decrease upon discharge; duration of untreated psychosis linked to small network.
Social Relationship Scale (SRS)	Patients with more negative symptoms have smaller support networks; more socially skilled have larger social networks.
Social Support and Social Network Interview (SSSNI)	Smaller network size was associated with clinical functioning and quality of life and self esteem were positively correlated with larger network sizes.

**Supplementary Table 2. Characteristics of Studies.**

Abdallah et al. (2009)	USA	NAP	N/A	Schizophrenia (older adults)	198	General population	113	Compared to the comparison group, the schizophrenia sample had less community integration scores.
Albert et al. (2011)	Denmark	SNS	N/A	Schizophrenia and related disorders	255	-	-	Number of friends was predictive of recovery at 5 years follow up.
Angell and Test (1998)	USA	ISSI	N/A	Schizophrenia	122	-	-	Small mean network size for men and women, the latter had more contact with the opposite sex and for both genders social networks characteristics predicted satisfaction with social relationships.
Argentzell et al. (2014)	Sweden	ISSI	N/A	SMI* (attending day centre )	40	SMI* (not attending day centre)	67	Day centre attendees had larger networks and a larger number of people they could ask to borrow things from.
Atkinson et al. (1996)	Scotland	SNS	Education	Schizophrenia	73	Schizophrenia	57	Intervention increased total number of contacts as well as number of confidants.
Bankole et al. (2006)	USA	NAP	N/A	Schizophrenia (older adults)	198	General population	113	The schizophrenia sample had less sustenance linkages than the general population sample and lower percentage of perceived reliable contacts. More reliable social contacts was associated with higher quality of life.
Bankole et al. (2008)	USA	NAP	N/A	Schizophrenia (older adults)	198	General population	113	Fewer social contacts was highly associated with remission in the schizophrenia sample.
Becker et al. (1997)	UK	SNS	N/A	SMI*	143	-	-	Increase in social network size decreased likelihood of hospitalization. Number of services used grew with social network size.
Becker et al. (1998a)	UK	SNS	N/A	Schizophrenia	129	-	-	Social networks are smaller in intensive service sector compared to standard service sector at 2 years.
Becker et al. (1998b)	UK	SNS	N/A	Schizophrenia	195	-	-	Quality of life positively related to number of social contacts.
Bengtsson-Tops (2001)	Sweden	ISSI	N/A	Schizophrenia out-patients	120	General population	180	Poorer network compared to normal sample in access, size and support.
Bengtsson-Tops (2004)	Sweden	ISSI	N/A	Schizophrenia	94	-	-	Changes in mastery was positively correlated to changes in access to social contacts.



Bengsstop- Tops & Hansson (2000)	Sweden	ISSI	N/A	Schizophrenia	120	-	-	An increased Sense of Coherence score was associated with a higher level of adequacy of social interaction.
Bengsstop- Tops & Hansson (2003)	Sweden	ISSI	New outpatient psychosis team	Schizophrenia (outpatients) – psychiatrist + supportive contact	26	Schizophrenia (outpatients) – psychiatrist contact	24	No difference in social network between the two groups.
Bjorkmann & Hansson (2000)	Sweden	ISSI	N/A	Schizophrenia and related disorders	90	-	-	More work time spend on indirect contacts on behalf of the client by case managers predicted an improved social network.
Bjorkmann & Hansson (2002)	Sweden	ISSI	N/A	Schizophrenia and related disorders	67	-	-	A decrease in symptoms and improvement in social networks predicted an improvement in subjective quality of life.
Bjorkmann & Hansson (2007)	Sweden	ISSI	N/A	Schizophrenia and related disorders	60	-	-	Scores on the ISSI were significantly higher at 6 years follow up for a cohort of patients with schizophrenia under a case management service.
Brunt and Hansson (2002)	Sweden	ISSI	N/A	SMI* inpatients	23	SMI* outpatients	51	No significant social networks differences between groups. Reported low scores on availability of social interaction in both groups as well and intermediate scores on the satisfaction of interaction. Emotional relationships were provided by immediate family and friends. There was also a positive correlation between ISSI score and the quality of life measure used in the study.
Catty et al. (2005a)	UK	SNS	N/A	SMI* day users of hospitals and centres	169	-	-	Longer duration of contact with services, more unmet needs, working and living in supported accommodation were associated with a larger network. Longer duration of contact was linked with having more confidantes.
Catty et al. (2005b)	UK	SNS	N/A	SMI* (attending day hospital)	121	SMI (attending day centre)	160	Day centre attendees had larger social networks and more intimate contacts than the comparison group.
Catty et al. (2012)	UK	SNS	N/A	SMI*	53	Anxiety, depression and personality disorders	40	Network size is not associated with therapeutic relationship ratings.
Clausen et al. (2014)	UK	SNS	N/A	First episode psychosis	578	-	-	People that had used cannabis had significantly less friends and family member they were in contact with.

Cohen et al. (2000)	USA	NAP	N/A	Schizophrenia (older adults)	198	General population	113	Number of confidants in the schizophrenia sample was not predictive of quality of life.
Cohen et al. (2008b)	USA	NAP	N/A	Schizophrenia (older adults)	198	General population	113	There was no statistically significant difference in number of sustenance links between older adults with schizophrenia who had suicide attempts in the past compared to those that hadn't.
Cohen et al. (2011)	USA	NAP	N/A	Schizophrenia (older adults)	198	General population	113	Number of sustenance links did not mediate the effect of coping strategy on quality of life.
Cohen and Sokolovsky (1978)	USA	NAP	N/A	Schizophrenia	22	General population (matched)	12	Patients have smaller social networks than controls
Dayson et al. (1998)	UK	SNS	N/A	SMI*	5	SMI	12	Data collected at 5 year follow up with a sample of discharged patients into 2 homes (one significantly larger than the other) showed that there was more social cohesiveness in the smaller home. Reasons as to why residents failed to form relationships in larger homes remains unexplained.
Denoff and Pilkonis (1987)	USA	NAP-M	N/A	Schizophrenia	103	-	-	Premorbid social adjustment had little direct effect on network system development.
Diwan et al. (2007)	USA	NAP	N/A	Schizophrenia (adults)	198	General population	113	Proportion of confidants was associated with clinical depression in the schizophrenia group.
Eklund (2006)	Sweden	ISSI	N/A	SMI*	60	-	-	No difference between occupational groups (working, visiting activity centres and no regular activities) regarding qualitative or quantitative aspects of social networks.
Eklund and Hansson (2007)	Sweden	ISSI	N/A	SMI* outpatients	103	-	-	Higher levels of QOL, self-esteem, living in a house were related to higher ratings on the social network measurements.
Eklund and Ostman (2010)	Sweden	ISSI	N/A	SMI*	60	-	-	There was a significant difference in aspects of social network between patients that scored lower on levels of satisfaction with sexual relations than those who scored higher with people from the latter group reporting larger social network and more satisfaction with daily activities/
Erikson et al. (1998)	Canada	ISSI	N/A	SMI*	48	-	-	More supportive nonkin relations in the social network at the onset of schizophrenia predicted adaptive

functioning 5 years after the first treatment.

Goddard et al. (2004)	UK	SNS	N/A	SMI*	43	SMI day patients	78	Social networks of discharged patients decreased.
Goldberg et al. (2003)	USA	SSSNI	N/A	SMI* outpatients	219	-	-	Network size (and not density) was related to quality of life, self-esteem and clinical symptomatology.
Hamilton et al. (1989)	USA	PPKI	N/A	Schizophrenia	39	-	-	Patients with more negative symptoms had smaller SNs. There were no correlations with positive symptoms.
Hansson et al. (2001)	Sweden	ISSI	N/A	Schizophrenia	300	-	-	The presence of unmet needs according to both patient and patient's key worker was associated with a worse social network,
Hansson et al. (2002)	Nordic countries	ISSI	N/A	Schizophrenia outpatients	418	-	-	SNs was perceived as better by persons with an independent housing regardless if they were living alone or not, or with family or not.
Horan et al. (2006)	USA	SNI	N/A	Schizophrenia	89	-	-	Social network generally stable across 15 month follow-up. Smaller social networks related to poor current and premorbid social functioning.
Hultman et al. (1996)	Sweden	ISSI	N/A	Schizophrenia or schizophreniform disorder	48	-	-	Patients with a good social network at the time of admission were discharged sooner, had a faster recovery from clinical symptoms and these positive effects continued into remission. At relapse, patients who had good social integration had fewer reported symptoms but more observed negative symptoms.
Hultman et al. (1997)	Sweden	ISSI	N/A	Schizophrenia	42	-	-	People with low social integration had a higher relapse rate at 4 years than patients lacking of social provisions but wanting more. In a sub-sample of patients interviews for life events, the buffering effect of social factors, time between life event and relapse was significantly higher in patients with a high availability of attachment on the ISSI.
Ibrahim et al. (2010)	USA	NAP	N/A	Schizophrenia (adults)	198	General population	113	The number of intimate contacts was used as part of a way of measuring "successful aging" in a schizophrenia sample compared to controls. This number was significantly smaller in the schizophrenia group.
Jeppesen et al. (2008)	UK	SNS	N/A	First episode psychosis	423	-	-	Longer duration of untreated psychosis and poorer pre morbid social adaptation was associated with a small

network at entry, 1 and 2 year follow up.

Joyce et al. (2000)	UK	SNS	N/A	Schizophrenia and related disorders	69	-	-	Total number of friends was predictive of the Experience of Caregiving Inventory (ECI).
Leff and Trieman (2000)	UK	SNS	N/A	SMI*	523	-	-	Size of patients' network didn't change at 5 years follow up. The number of confidants and friends however, increased in the first year, differing significantly from the baseline after 5 years in the community.
Lim et al. (2014)	USA	SRS	N/A	Psychosis	25	General population New Religious Movement = 29	63	Compared to the New Religious Movement group, people in the psychosis group had less crisis supports, unique supports, overall supports and less helpful and reciprocal relationships.
Lindsted (2006)	Sweden	ISSI	N/A	Offenders with SMI*	40	-	-	Importance of daily activities was highly correlated with social participation measured by the ISSI.
Lipton et al. (1981)	USA	NAP-M	N/A	First-admission schizophrenia	15	Multiple admission schizophrenia	15	Networks of first-admission patients are larger and more inter-connected, have more multiplex and non-dependent links compared to multiple admission patients.
Macdonald et al. (1996)	Australia	SRS	N/A	First admission schizophrenia outpatients	18	Multiple admissions schizophrenia outpatients (history of 3 and more admissions)	28	Patients with more negative symptoms have smaller social support networks; patients who were more socially skilled have larger social networks ; younger people have larger networks than older people; no difference in perceiving support between all levels of social skilled patients/ young-old groups
Macdonald et al. (2000)	Australia	ASRS	N/A	Early psychosis	26	General population	26	Psychosis group had significantly smaller networks, fewer friends, fewer people to turn into a crisis and a higher likelihood of service providers as members. No difference in perceived social support, no of family members and no of participants with acquaintances.
Mattson et al. (2008)	Sweden	ISSI	N/A	First episode psychosis (recovered and unrecovered)	71	General population	284	Both recovered and non-recovered patients had smaller social networks compared to controls. Size, quality of network and perceived financial strain were predictive of the outcome.
Meeks and Murrell (1994)	USA	NAP	N/A	Schizophrenia and related disorders	27	General population	19	People with SMI have smaller networks which are less reciprocal and contained fewer family members

Middleboe (1997)	Denmark	SNS	N/A	SMI*	37	-	-	Number of reciprocal supportive contacts in the social network increased for a sample of patients with SMI part of a programme of small supportive group homes.
Mitchell (1989)	USA	ASSIS	N/A	SMI* outpatients	150	-	-	Social networks might be important in predicting mental health services utilization.
Nettelbladt et al. (1995)	Sweden	ISSI	N/A	Schizoaffective disorder	18	Diabetes patients =10. Normal controls =8		Patients with schizoaffective disorder had less access to social relations and were less satisfied with their emotional relationships
Pattison and Pattison (1981)	USA	PPKI	N/A	Schizophrenia	1	-	-	Dynamics of a small network provide a pathogenic source of interpersonal relationships.
Pernice-Duca and Onaga (2009)	USA	SSSNI	N/A	SMI*	221	-	-	Network size decreased over time due to less professionals involved in care and recovery was positively correlated with qualitative aspects of network such as support, reciprocity.
Petersen et al. (2005)	Denmark	SNS	Integrated treatment	Schizophrenia and related disorders (integrated treatment)	275	Schizophrenia and related disorders (usual treatment)	272	There was no significant difference between the two groups regarding the median number of friends and family.
Sapra et al. (2006)	USA	NAP	N/A	Schizophrenia (older adults)	198	General population	113	The proportion of intimate contacts was not associated with any of the subscales of the Rating of Medication Influences Scale (ROMI) in the schizophrenia sample.
Soorgard et al. (2002)	Scandinavia (multicentre )	ISSI	N/A	Schizophrenia	418	-	-	Use of support contacts outside mental health professionals was associated with female sex, rural living and low GAF.
Sorgaard (2001)	Scandinavia (multicentre )	ISSI	N/A	Schizophrenia	418	-	-	Number of contacts related to high GAF, few BPRS negative and hostility symptoms, having contact with services and living in urban vs. rural areas.

Stein et al. (2013)	USA	SNS	N/A	SMI*	60	Parents of patients	30	Parents have more social networks than their children. Parents' reports of personal loss due to mental illness is related to their perceptions of social support.
Thornicroft & Breaky (1991)	UK	SNS	N/A	Schizophrenia	97	-	-	Patients in longer contact with COSTAR <sup>2</sup> programme had improved social function and in quality and quantity of SNs.
Thorup et al. (2006)	Denmark	SNS	Therapy, social skills training, family intervention	Schizophrenia (intervention)	275	Schizophrenia	272	Premorbid functioning, network size at entry and long duration of untreated psychosis is related to small SN size. Intervention was not able to address this problem.
Thorup et al. (2007)	Denmark	SNS	N/A	Schizophrenia	578	-	-	Men have poorer social networks than women.

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<sup>2</sup> Community Support Treatment and Rehabilitation programme is a mobile treatment and case management service for SMI populations in Baltimore. Each patient is assigned a psychiatrist and nurse or social worker who work directly with them with a frequency of contact of 3 per week on an average

SMI\* = sample was >50% schizophrenia or related disorders

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